Michigan Green Chemistry Governor's Award

The Michigan Green Chemistry Governor's Award Program recognizes advances that either incorporate the principles of green chemistry into chemical design, manufacture, or use, or that promote activities which support or implement those technologies.

The Awards program, which is Michigan specific, is governed by the following focus areas:

Greener Synthetic Pathways

This focus area involves implementing a novel, green pathway for a new chemical product or material. It can also involve using a novel, green pathway to redesign the synthesis of an existing product.

Greener Reaction Conditions

This focus area involves improving conditions other than the overall design or redesign of a synthesis.

Design or Implementation of Greener Chemicals and Materials

This focus area involves designing or deploying chemical products or materials that are less hazardous than the products or technologies they replace.

Design, Implementation, or Advocacy of Greener Processes

This focus area involves advocating for, designing, or deploying a process where chemicals (particularly hazardous and/or toxic chemicals) were used in such a way that the resulting process will be environmentally benign and economically sound and readily operated, while still ensuring product quality.

ACADEMIC

K. Y. Simon Ng, PhD, P.E.

Associate Dean, College of Engineering at Wayne State University

Heterogeneous Metal Oxide Catalysts for Biodiesel Production

Simon Ng, Ph.D., P.E. and colleagues at Wayne State University have developed novel heterogeneous metal oxide catalysts that enable the economical production of biodiesel from cost-effective raw materials – such as waste vegetable oil, animal fats and residual corn oil - while eliminating costly and unnecessary waste production and disposal. This technology offers a unique process solution for an industry that has been mostly idled in the United States since 2008, when rising feedstock prices rendered the production of biodiesel uneconomical. With a cost savings of at least $1 per gallon versus the traditional biodiesel production process, Ng's solution greatly changes the economics of a biodiesel plant.

In addition to the cost and energy savings associated with biodiesel fuel, there are several advantages that make it a smart choice to manufacture and use. Biodiesel is nontoxic and biodegradable, and therefore it is environmentally safe. Advanced biofuels in general are produced domestically, thus lessening the dependence on foreign oil. Also, producing advanced biofuels can stimulate the local economy through job creation in farming, transportation and production.

Benefits of this technology are the low cost of the catalysts with a long life, and it does not pose any environmental or human health hazards. It can be used in a continuous process configuration, improving on the current batch processing methods, and it allows a greener synthesis pathway for biodiesel production by eliminating side reactions and the need for a caustic homogeneous catalyst. The reaction conditions generate much less waste and the technology enables the use of more economical renewable feedstocks for fuel production, reducing the need for fossil fuels.

This technology is being commercialized by a Michigan-based startup company, NextCAT, formed by Dr. Ng and colleagues, and promises to make biodiesel production a profitable commercial enterprise in Michigan and around the world.

"I am pleased that the biofuel catalyst technology developed at the National Biofuels Energy Laboratory at Wayne State University has been selected for a Michigan Green Chemistry Governor's Award. With the funding NextCAT received from the National Science Foundation, and recognition from programs such as this, Ng's team is very close to commercializing their catalyst which will contribute to energy sustainability and security improvements. We are confident that their novel technology will spur the biofuels industry and be an active part of America's energy security." -Dr. Hilary Ratner, Vice President for research and interim Dean of the Graduate School at Wayne State University

WAYNE STATE UNIVERSITY

SMALL BUSINESS

KTM Industries, Inc.

Tim Colonnese, President
Ramani Narayan, Chief Technology Officer & University Distinguished Professor, Michigan State University, Department of Chemical Engineering & Materials Science

Biodegradable, Modified Starch Polymers for Protective Foam Packaging and Insulation Applications

KTM Industries, a Lansing company, has successfully commercialized biodegradable, starch foams under the trade name of GreenCell for protective packaging and insulation cooler markets.

The technology was designed and engineered at Michigan State University. It is a one step, reactive extrusion process using water as the plasticizer and blowing agent along with suitable polymer modifiers to generate the cellular starch foam. After use, it can be completely disposed of in an environmentally responsible manner in soil or in compost operations, where it becomes a nutrient (food) for the soil. The bioplastic foam has the performance characteristics of today's polyethylene-based foam in cushion protective packaging and thermal insulation properties for coolers.

Petro-fossil foam plastics have no viable, end-of-life disposal options. Substituting petro/fossil carbon based polyethylene, polystyrene, or polyurethane foams used in disposable protective packaging with biobased, renewable carbon from agricultural feedstocks offers a reduced carbon footprint and complete biodegradability as measured by ASTM/ISO standards.

The technology provides new value added products for Michigan farmers and supports the bioeconomy of the State. The foam product is 95%+ starch based and replaces petro based polyethylene protective packaging foam and both polystyrene and polyurethane insulation foam packaging. The biofoam product is completely biodegradable in compost, soil, and marine environments.

"KTM in partnership with Michigan State University is pleased to receive the Michigan Green Chemistry Governor's award. The award honors and showcases university-small business partnership for manufacturing new green biobased products - the new green bioeconomy in practice. We are at the beginning of this new green economy curve and envision the creation of new green manufacturing jobs as more companies look to biobased and biodegradable products packaging solutions."

GCF GREEN CELL FOAM
biobased & biodegradable

Recycled Polymeric Materials, Inc.

Mr. George Hill, Chairman & CEO, DCT, Inc.
Mr. Arnold Joseff, President, DCT, Inc.
Mr. Reuben Tandoh, M.S., Technical Director, RPM, Inc.
Dr. Rajan Eadara, Vice President, R & D, DCT, Inc.

Engineered Materials Made by Combining Recycled and Bio-renewable Resources

Recycled Polymeric Materials, Inc. manufactures heating, ventilation, and air conditioning seals in Detroit. The technology involves utilization of recycled crumb rubber that would otherwise be sent to a landfill. The chemistry is based on reactive ingredients of soy-based polyol, an annually renewable nonpetroleum resource. Manufacturing involves ambient temperature reactions versus traditional energy-intensive vulcanization process for rubber. Weight reduction and a faster process enhance the engineering properties.

Polyurethane foam gaskets offer significant advantages over competitive materials such as vulcanized ethylene propylene diene monomer rubber. The energy use in manufacturing is significantly reduced, and part weights may be reduced significantly by about 30-40% compared to vulcanized rubber. Also, curatives used in the vulcanization of rubber are often highly toxic. Recognizing the need to incorporate a significant amount of annually bio-renewable content, along with post consumer recycled rubber, led to the development of a novel chemistry.

Soy-based polyol and corn-based chain extenders have been combined along with finely ground recycled rubber from scrap tires and incorporated into the polymer matrix to compose of 25-40% of the finished part weight. This technology has been shown to be production feasible and commercially viable, meeting the stringent specifications of the automotive industry.

The seals are manufactured using production equipment manufactured in Michigan, and exported to over 15 countries throughout the world. Many competitive products are imported into the United States; this technology could replace most of these imported products. The seals are approved by major automobile manufacturers and are used on over 38 vehicle platforms. Millions of parts have already been supplied to global automotive manufacturers.

“With a burgeoning global population, we must find ways to accomplish economic growth, provide jobs, while reducing the attendant demand for raw material resources. This has to be done while effecting a lessening of the demand on the environment. It is our belief that this can only be accomplished through the use of both recycling and utilization of sustainable materials.”